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radc, usaf ltr, 8 nov 1982

RADC-TR-76-19
Technical Report
February 1976

DIRECT DIGITAL MODULATION CONVERTER (DDMC)

Operating Manual

Sherbrooke University

Rome Air Development Center
Air Force Systems Command
Griffiss Air Force Base, New York 13441

This report has been reviewed and approved for publication.

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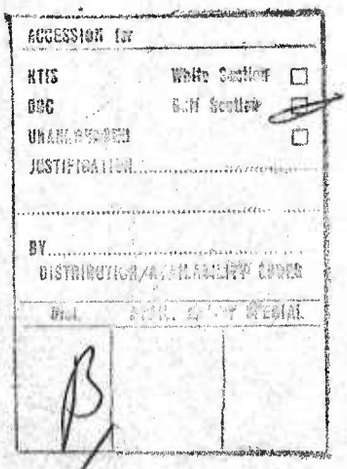

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REPORT DOCUMENTATION PAGE	READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER: RADC-TR-76-19	2. GOVT ACCESSION NO. / 3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle): DIRECT DIGITAL MODULATION CONVERTER (DDMC) Operating Manual	5. TYPE OF REPORT & PERIOD COVERED: Technical Report Jun 73 - Dec 74
	6. PERFORMING ORG. REPORT NUMBER: DS-003
7. AUTHOR(s): Lionel Charrier	8. CONTRACT OR GRANT NUMBER(s): F30602-72-C-0430
9. PERFORMING ORGANIZATION NAME AND ADDRESS: Sherbrooke University Sherbrooke Quebec Canada	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS: 62702F 65230124 AF-6523
11. CONTROLLING OFFICE NAME AND ADDRESS: Rome Air Development Center (DCLT) Griffiss AFB NY 13441	12. REPORT DATE: February 1976 / 13. NUMBER OF PAGES: 13 (12) 15 p.
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office): Same	15. SECURITY CLASS. (of this report): UNCLASSIFIED / 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE: N/A

16. DISTRIBUTION STATEMENT (of this Report)

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17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

Same

18. SUPPLEMENTARY NOTES

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19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Codex, Voice, Interface

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This system was built to provide digital conversion from pulse code modulation (PCM) to Delta Modulation and the reverse. The operation manual describes operation procedures so the equipment can be operated properly.

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TABLE OF CONTENT

DDMC OPERATING MANUAL

1 Introduction

This system was built to provide digital conversion from pulse code modulation (PCM) to delta modulation or vice-versa.

This notice describes the connections from the DDMC to its power supply and to the different PCM channel banks which can be used with it. Channel selection is also described.

The DDMC is furnished with its power supply, a 6 foot power supply cable and a telephone set.

2 Identification

An engraved identification is provided on the front panel (Figure 1).

3 Physical description

3.1 Dimensions

The DDMC is mounted on two standard 19" racks, the two racks being tied together. The maximal physical dimensions are:

Width : 19"

Heigth : 14"

Depth : 14"

The power supply is mounted in LAMBDA 19" rack LRA11 whose maximal physical dimensions are:

Width : 19"

Height : 5" 7/12

Depth : 24"

3.2 DDMC description

Figure 1 and 2 show the DDMC front and rear panels. Figure 1 shows the TEST AMPLIFIER and TEST-POINT BOARD (see pages 5 and 6).

3.2.1 DDMC front panel

3.2.1.1 "T" board identification strip

A number corresponding to each "T" board number is printed on the strip. The position of each board is then clearly defined

3.2.1.2 "B" board identification strip

Defines in the same way the "B" board position.

3.2.1.3 "T" board location

Reserved space for the "T" board.

3.2.1.4 "B" board location

Reserved space for the "B" board.

3.2.1.5 FΔ selection switch

Permits the selection of one of four delta frequencies by pushing on the desired frequency button.

16 means that the delta frequency is 16 kHz

19 means that the delta frequency is 19.2 kHz

32 means that the delta frequency is 32 kHz

38 means that the delta frequency is 38.4 kHz

The selected button will light.

3.2.1.6 PCM bank selection switch

Makes the selection of one of four PCM systems by pushing on the desired button.

"TD660" means that the selected PCM system is the TD660 channel bank. "D1" means that the selected PCM system is the D1 channel bank. "A" means that the selected PCM system uses the A companding law and the 30-32 channel configuration (in Europe). "TD968" means that the selected PCM system is the TD968 channel bank.

The selected button will light.

3.2.1.7 Audio signal in

This BNC connector is used to enter an audio signal into the DDMC (delta to PCM conversion).

3.2.1.8 Audio signal out

This BNC connector gives the audio output of the DDMC PCM-to-delta conversion.

3.2.1.9 Telephone set jack

This dual jack is used to connect a telephone set to the DDMC. The upper and lower jacks are respectively the receive and transmit jacks (Technical Report, Phase II, Appendix B, drawing B22).

When entering the jacks, the AUDIO SIGNAL IN and AUDIO SIGNAL OUT are disconnected. The entrance of the analog delta modulator (Board B22) is then the telephone microphone. The output of the analog delta demodulator (Board B22) is then the telephone speaker.

3.2.1.10 Frame alarm light and pushbutton

When frame synchronization has been lost, the frame light goes on. If pushing the frame pushbutton makes the light go off frame synchronization is good again. If the light does not go off, a trouble-shooting procedure must be started (Technical Report, Phase II, Appendix D).

3.2.1.11 Test amplifier and test point board

This board (Figure 1) contains the amplifier used in the TEST of the DDMC (Technical Report, Phase II, Chapter 4).

The upper BNC connector is the output of the amplifier.

The "A < INPUT" is used in the Δ to PCM analog conversion (Technical Report, Phase II, Section 4.1.1.5).

The "A < 1" gain is adjusted with the A < 1 adjustment.

The "A > 1 INPUT" is used in the PCM to Δ analog conversion (Technical Report, Phase II, Chapter 4.1.3).

The "A > 1" gain is adjusted with the A > 1 adjustment.

The ten OUT and the ten IN pins on the right side of the board are reserved for the use of the European companding law.

The syllabic filter outputs (SYL pins) and the integrator outputs (INT pins) for analog modulator (MOD) and for the analog demodulator (DEMOD) are provided for tests or/and adjustments of the delta codec (4.2)

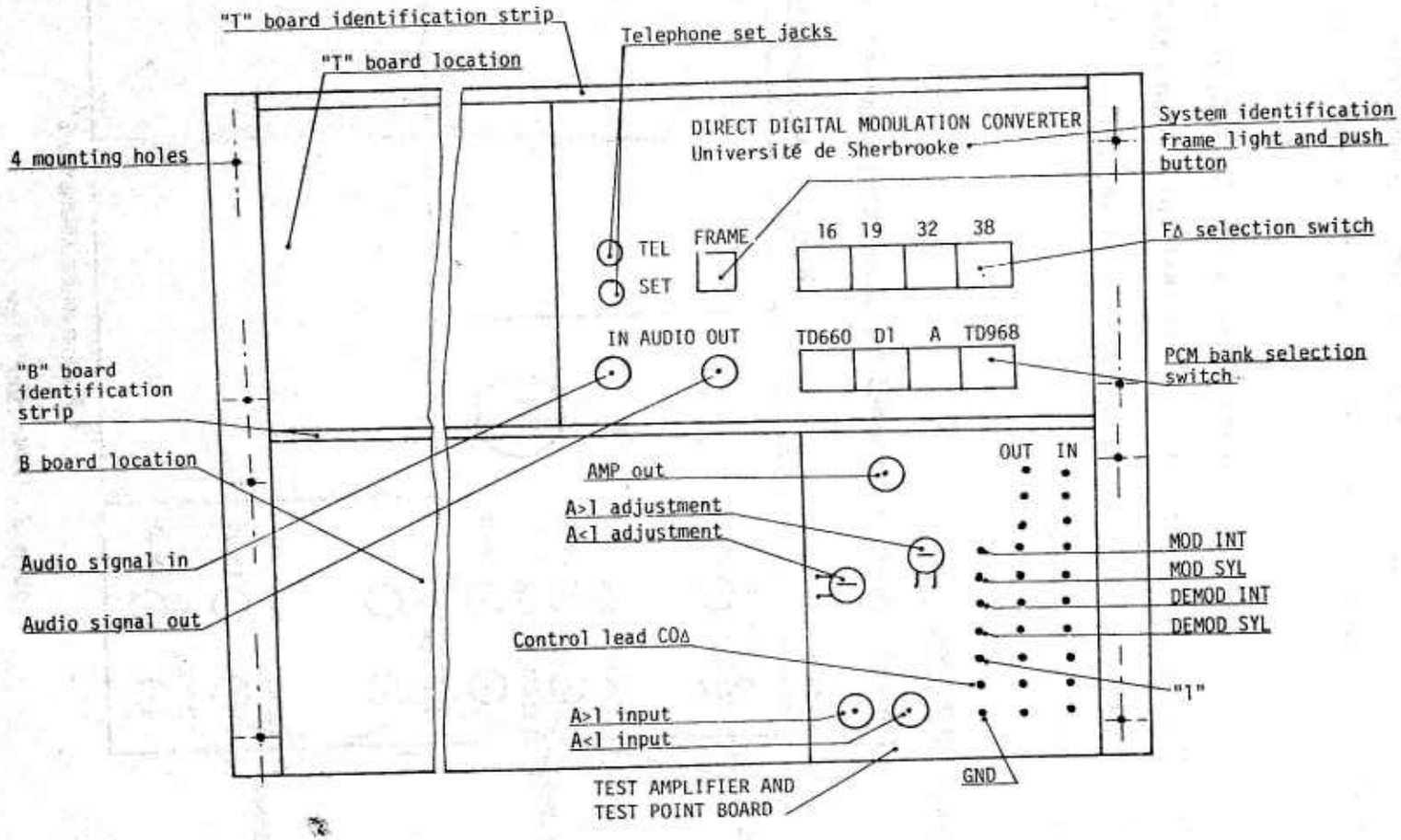

Figure 1 DDMC front view

3.2.1.12 Control lead

This lead controls the delta codec connections. Control lead COΔ must be connected to the GND pin for normal operation of the DDMC.

When COΔ is connected to the "1" pin,the analog delta codec is connected back-to-back which means that the analog modulator output becomes the analog demodulator delta input (used in Section 4.1.1.2 of the Technical Report, Phase II).

3.2.2 DDMC rear panel

The rear panel is provided for connection purposes only.

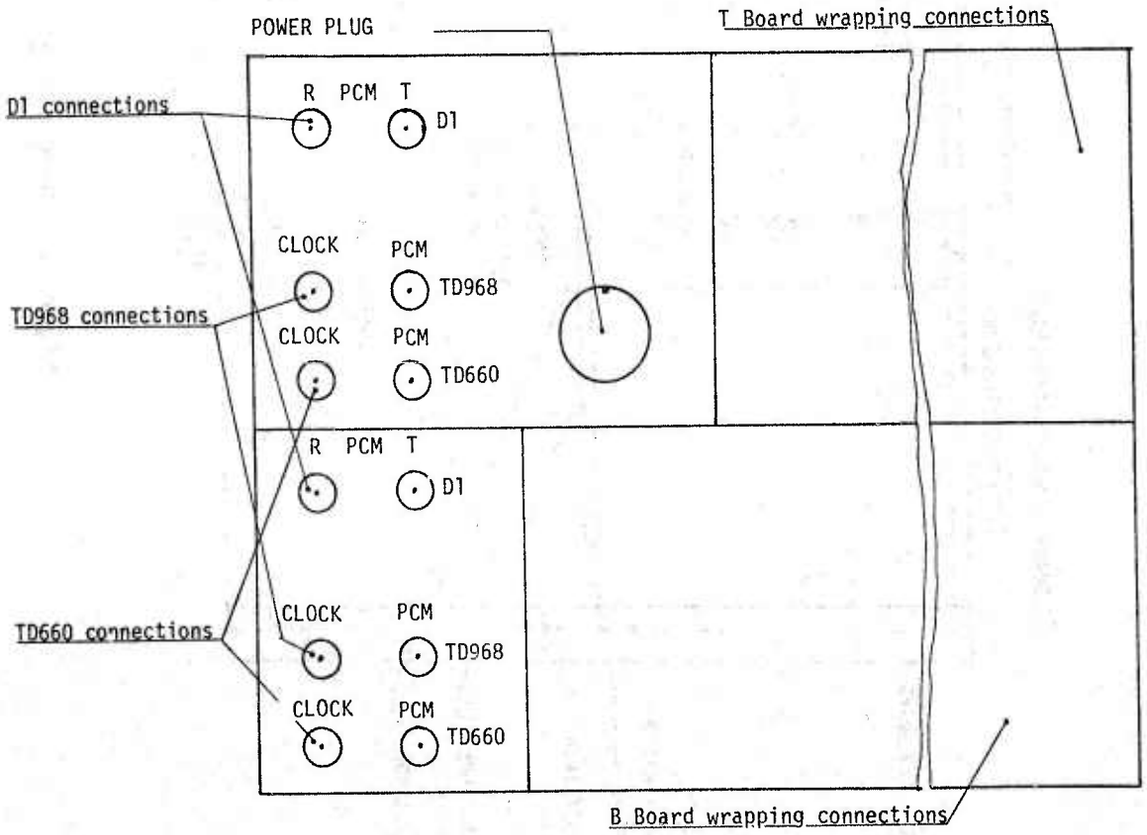

Figure 2 DDMC rear view

3.2.2.1 "T" (or "B") board wrapping connections

All the inter-board connections are provided on the rear connectors. Those connections are described on the WT (or WB) drawing of Annex B (Technical Report, Phase II).

The leads are coded with two letters: the first one refers to the connector pin, the second one to the top (H) or bottom (B) part of the connector. This code is used either for the "B" board wrapping connectors or for the "T" board wrapping connectors. The connector pin letters are printed on the connector.

3.2.2.2 Power plug

This plug is used to connect the power supply to the DDMC by means of a 6 foot cable.

3.2.2.3 D1 connections

Two separate BNC plugs are provided for the "R" and "T" PCM wires:

The upper ones are for receiving (PCM → Δ conversion)

The lower ones are for transmitting (Δ → PCM conversion)

3.2.2.4 TD968 connections

Two BNC plugs are provided for each way, one for the PCM data, the other for the PCM clock.

The upper ones are for receiving (PCM → Δ conversion)

The lower ones are for transmitting (Δ → PCM conversion)

3.2.2.5 TD660 connections

Two BNC plugs are provided for each way, one for the PCM data, the other for the PCM clock.

The upper ones are for receiving (PCM → Δ conversion)

The lower ones are for transmitting (Δ → PCM conversion)

3.3 Power supply description

A connector is provided on the rear panel to connect the power supply to the DDMC by means of a 6 foot cable. Remote sensing connections are made to prevent cable drop.

A plug is also provided on the rear panel for connection to the line (120V, 50-60 Hz).

A general switch and an ON indicating light are included on the front panel.

Protection is provided by a 5 amp fuse mounted on the front panel.

Identification is engraved on the front panel.

3.4 Power supply cable

A power supply cable with a plug on each end is provided for connection of the DDMC to the power supply.

3.5 Telephone set

A standard telephone set is provided with the equipment.

The dual telephone jack must be connected with the reference side in the down position.

4 Preliminary adjustments

4.1 Delta frequency adjustments

Connect a frequency-meter to Board B22 RH pin (located on rear connector).

- put the FΔ selection switch to 38
- adjust R27 (on board B22) to get a 38.4 kHz reading
- put the FΔ selection switch to 32
- adjust R28 (on board B22) to get a 32 kHz reading

4.2 Delta codec adjustments

- Put the FΔ selection switch to 19
- Connect the CVSD analog codec back-to-back with the control lead COΔ at "1" (3.2.1.11)
- Connect a short-circuit terminal to the AUDIO IN
- Connect an oscilloscope to the MOD INT pin on the TEST AMPLIFIER and TEST-POINT BOARD
- Adjust the modulator potentiometer R130 to get a stable triangular signal; adjust the modulator potentiometer R60 to get a 40 mV peak-to-peak triangular signal (R130 and R60 are located on Board B22)
- Disconnect the oscilloscope from pin MOD INT and connect it to the DEMO INT on the TEST AMPLIFIER and TEST-POINT BOARD
- Adjust demodulator potentiometer R130 to get a zero - mean valued signal and demodulator potentiometer R60 to get a 20 mV peak-to-peak triangular signal (R130 and R60 are located on Board B22)

5 "Operating procedure"

The following section contains information about the connections to be made for the installation of the DDMC.

1. Connect the power supply to the DDMC by means of the power supply cable (3.4).
2. Connect the line plug of the power supply to a 120 V, 50-60 Hz line (3.3).
3. Connect the transmitting and receiving wires from the transmitting and receiving parts of the DDMC to the transmitting and receiving parts of the equipment to be used (3.2.2).
4. Select the desired equipment with the PCM bank selection switch (3.2.1.6).
5. Select the desired delta frequency with the FΔ selection switch (3.2.1.5).
6. On the TEST AMPLIFIER and TEST-POINT BOARD, connect the COΔ pin to GND pin (CAUTION: disconnect COΔ from "1" pin).
7. Plug the telephone set into the dual jack (3.5).
8. Select the desired channel to be used for transmitting and receiving direction.
   a) DDMC transmitting direction:
      (i) Take off plug in board B4 "INTERFACES COUNTERS".
      (ii) If channel N is the desired one, strap the "N" output to the CHN lead pin DB; for the D1 system $1 \leqslant N \leqslant 24$; for the other systems $1 \leqslant N \leqslant 12$. To find the "N" output, use the following table.

Time interval N	Circuit number	Pin number
1	16	13
2	16	12
3	16	11
4	16	10
5	17	13
6	17	12
7	17	11
8	17	10
9	18	13
10	18	12
11	18	11
12	18	10
13	19	13
14	19	12
15	19	11
16	19	10
17	20	13
18	20	12
19	20	11
20	20	10
21	21	13
22	21	12
23	21	11
24	21	10

For example: if we want the DDMC to transmit on the Channel 6, the CHN lead must be strapped with circuit 17, pin 12.

(iii) Plug in board B4.

b) DDMC receiving direction:

(i) Take off plug-in board T3 "INTERFACES COUNTERS".

(ii) If channel N is the desired one,

- strap the N output to the CHN lead (pin EH);
- strap the "N-5" output to the CHN-5 lead (pin DB);
- strap the "N-9" output to the CHN-9 lead (circuit 39, pin 3).

Refer to a) "DDMC transmitting direction" for explanation of N.

(iii) Plug in board T3.

9. Switch on the PCM channel bank used switch on the DDMC, the system is now ready to operate.

10. The DDMC FRAME light must go ON, but must go OFF when pushing on it. If not, start a trouble shooting procedure (technical Report, Phase II, Appendix D).

11. If necessary, perform PRELIMINARY ADJUSTMENTS (4).

6 References

References are made to the Technical Report, Phase I, DS002 and to the Technical Report, Phase II, DS003.

Both reports are for US Contract F30602-72-C0430.

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AD B010031

AUTHORITY: RADC, USAF
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